

**Projecting COVID-19 Deaths and Hospitalizations
for Region 4 of the Kentucky Regional Hospital
Preparedness Program (HPP) Coalition
from August 18 to October 17, 2020**

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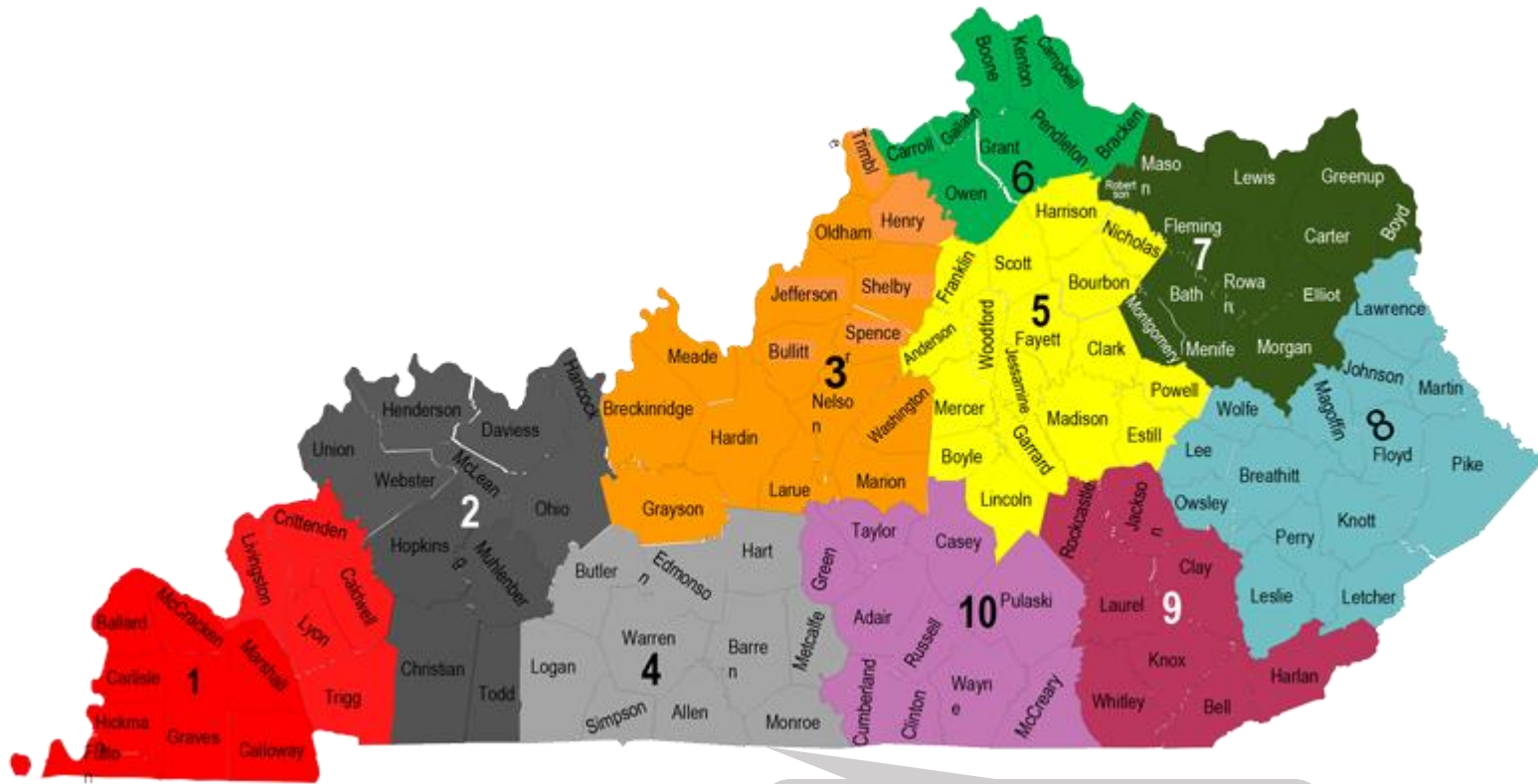
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Takeaways:

- If mobility rates do not change, an increase in the rate of mask-wearing is expected to prevent ~55–67 additional active hospitalizations and ~23–43 excess deaths in mid-October 2020.
- If mask-wearing rates do not change, a persistent bi-weekly increase in mobility can result in ~119–401 additional active hospitalizations and ~50–123 excess deaths in mid-October 2020.
- If both mask-wearing and mobility rates increase moderately, the number of hospitalizations and deaths is expected to be close to the current status quo (when neither mask-wearing nor mobility rate change) projections.
- If mobility rates increase moderately, a high increase in mask-wearing rate would result in preventing ~48-144 excess hospitalizations and ~34-77 deaths based on this model.
- However, a high increase in the mask-wearing rate is not expected to prevent excess hospitalizations and deaths if mobility increases at a high rate. In this scenario of high increases in mobility and in mask wearing, ~77 additional active hospitalizations and ~22 excess deaths are expected in mid-October 2020.
- In summary, increasing mask wearing is projected to prevent excess hospitalizations and deaths; however, the estimated benefits of increasing mask wearing will be attenuated if mobility increases at high rates:

Mask wearing cannot/will not be able to mitigate high mobility rates.

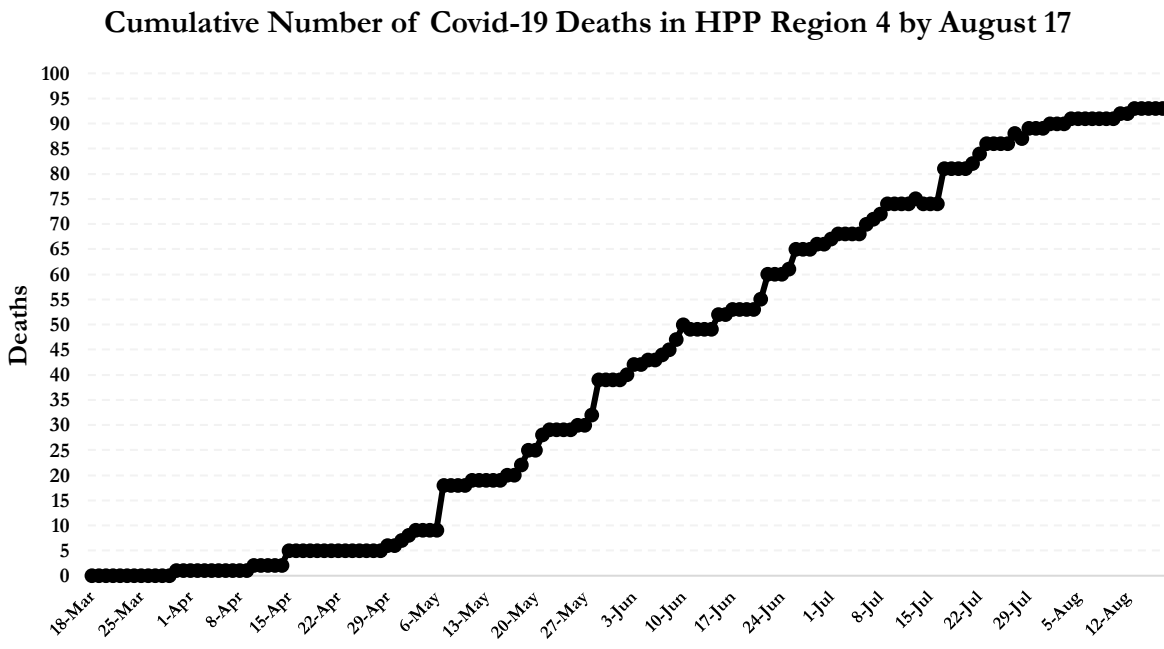
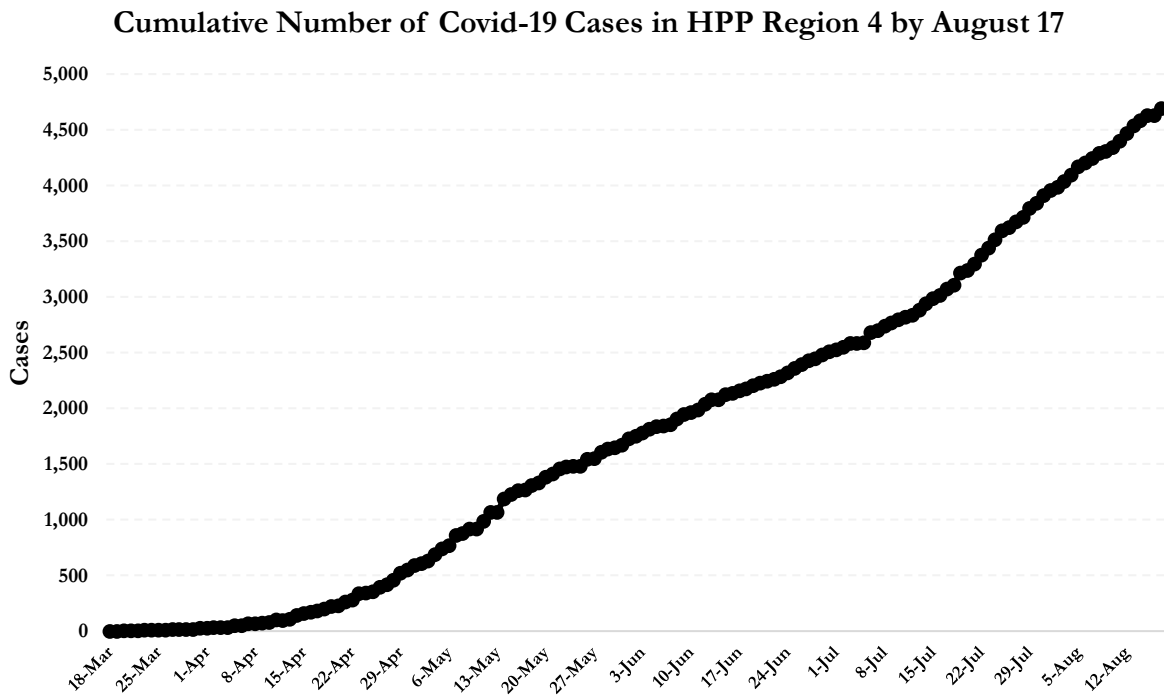
Kentucky Regional Hospital Preparedness Program (HPP) Coalition



Source: <https://kyepltc.org/hospital-preparedness/coalitions/>

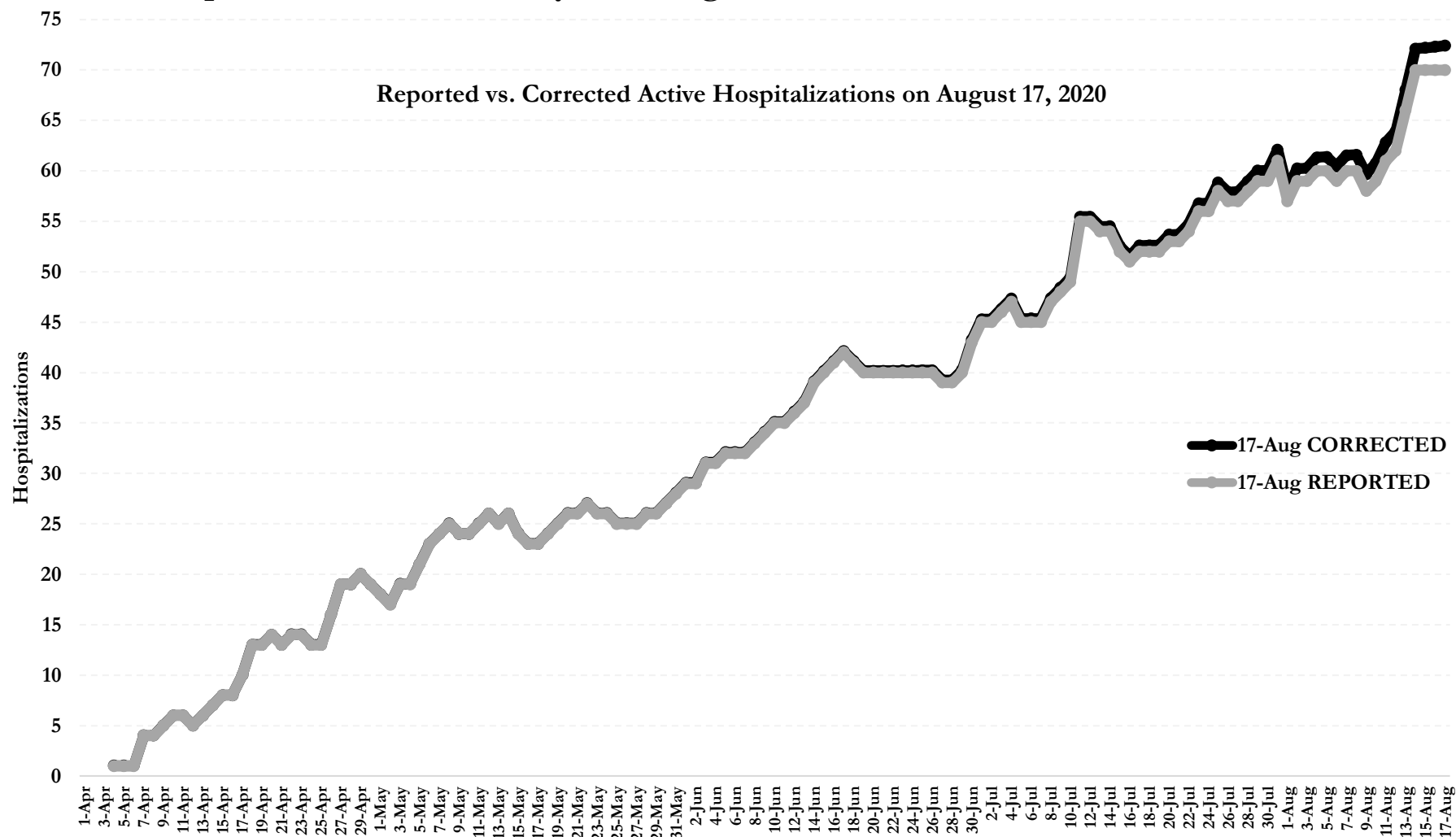
HPP Region 4 Counties:
Allen, Barren, Butler, Edmonson,
Hart, Logan, Metcalfe, Monroe,
Simpson, Warren

Covid-19 Cases and Deaths in Kentucky HPP Region 4



Source: Authors calculations from the New York Times Data ([link](#))

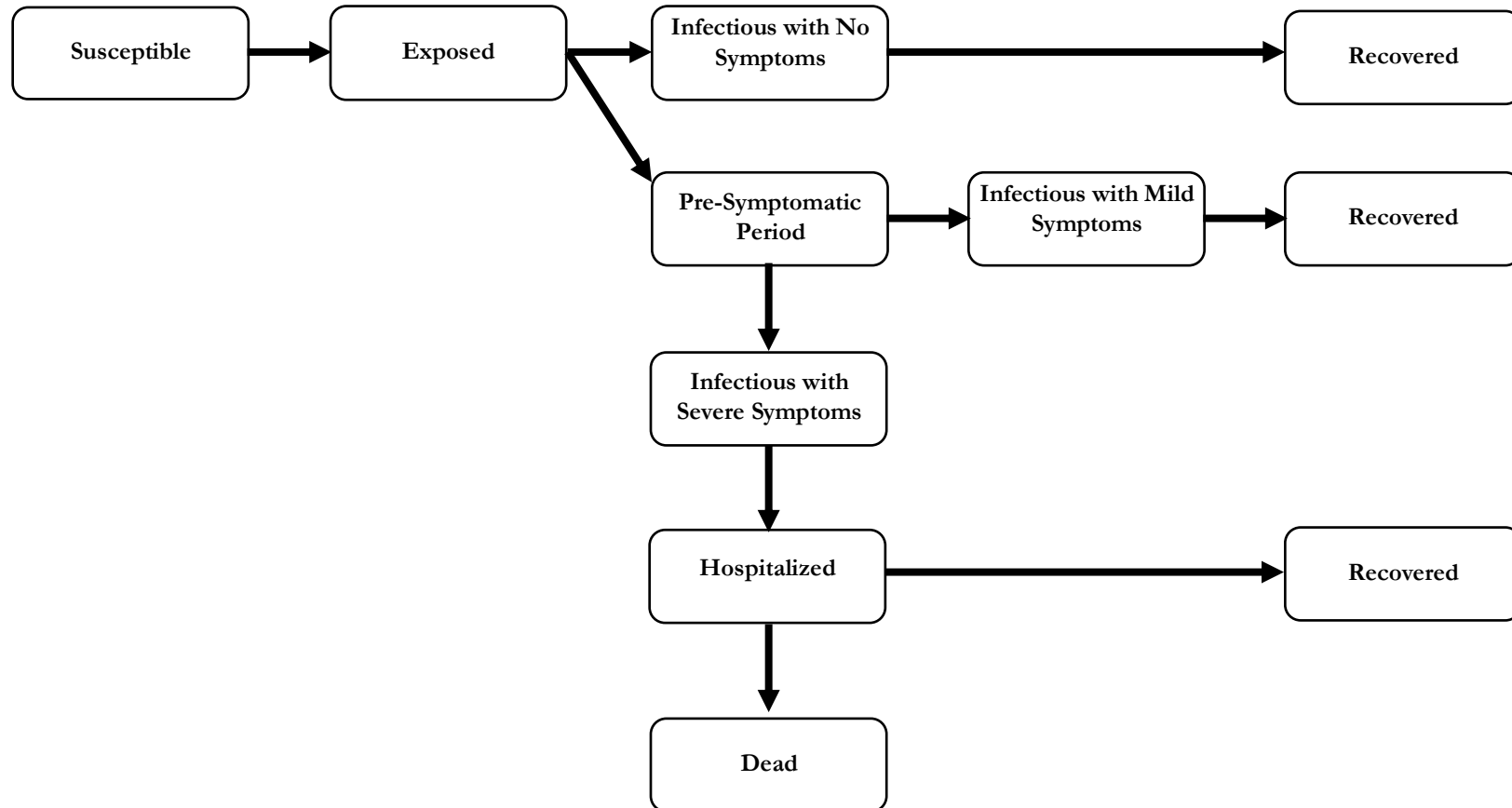
Covid-19 Hospitalizations in Kentucky HPP Region 4



Note: Hospitalization numbers reported on Aug. 17 were corrected to account for the delays in reporting hospitalizations based on the mean reporting error in previous reportings on Aug. 10, Aug. 3, Jul. 27, Jul. 20, Jul. 13, Jun. 29, Jun. 15, Jun. 8, Jun. 2, May 26, May 20, and May 14.

Source: Kentucky Health Information Exchange (KHIE).

A Conceptual Framework for Modeling Covid-19 Pandemic in HPP Region 4 (a SEIR model):

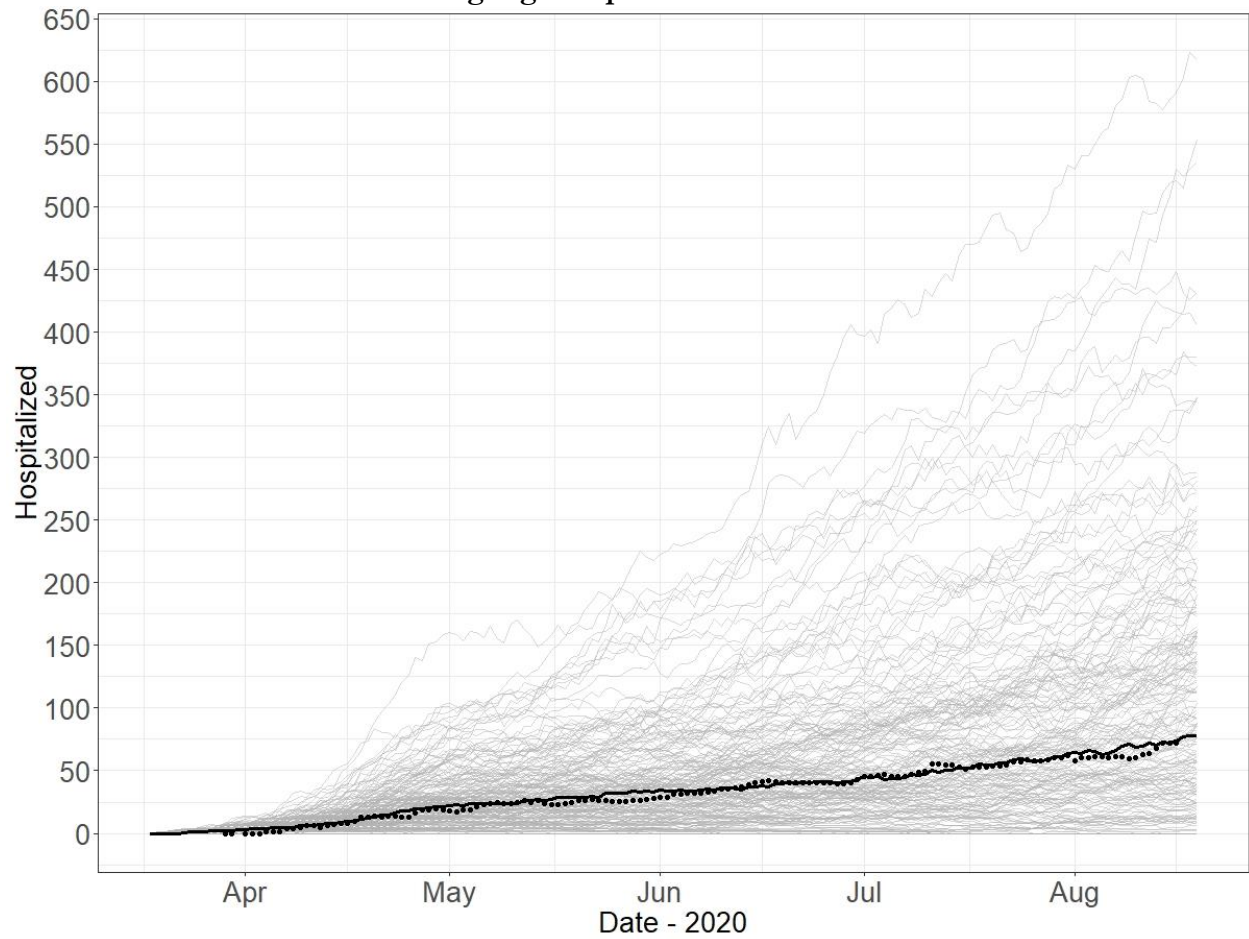


The fit of the SEIR model to the actual data, using the transmission and clinical parameters estimates from the region, the State, and the related literature

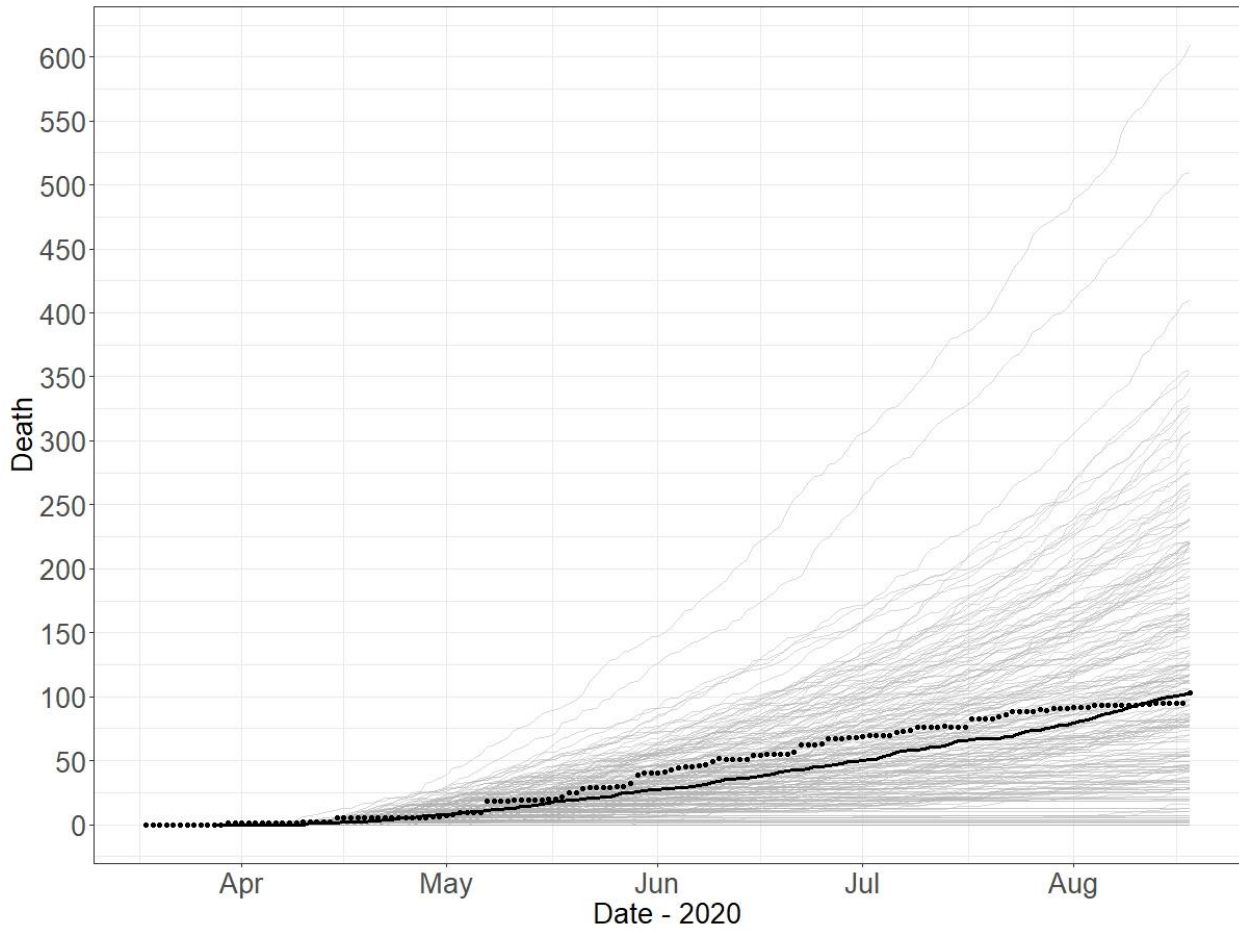
Active Covid-19 hospitalization for the period March 15 to August 17, 2020 in Kentucky HPP Region 4:

The dotted line indicates the observed data.

The highlighted path shows the median of 200 simulations.



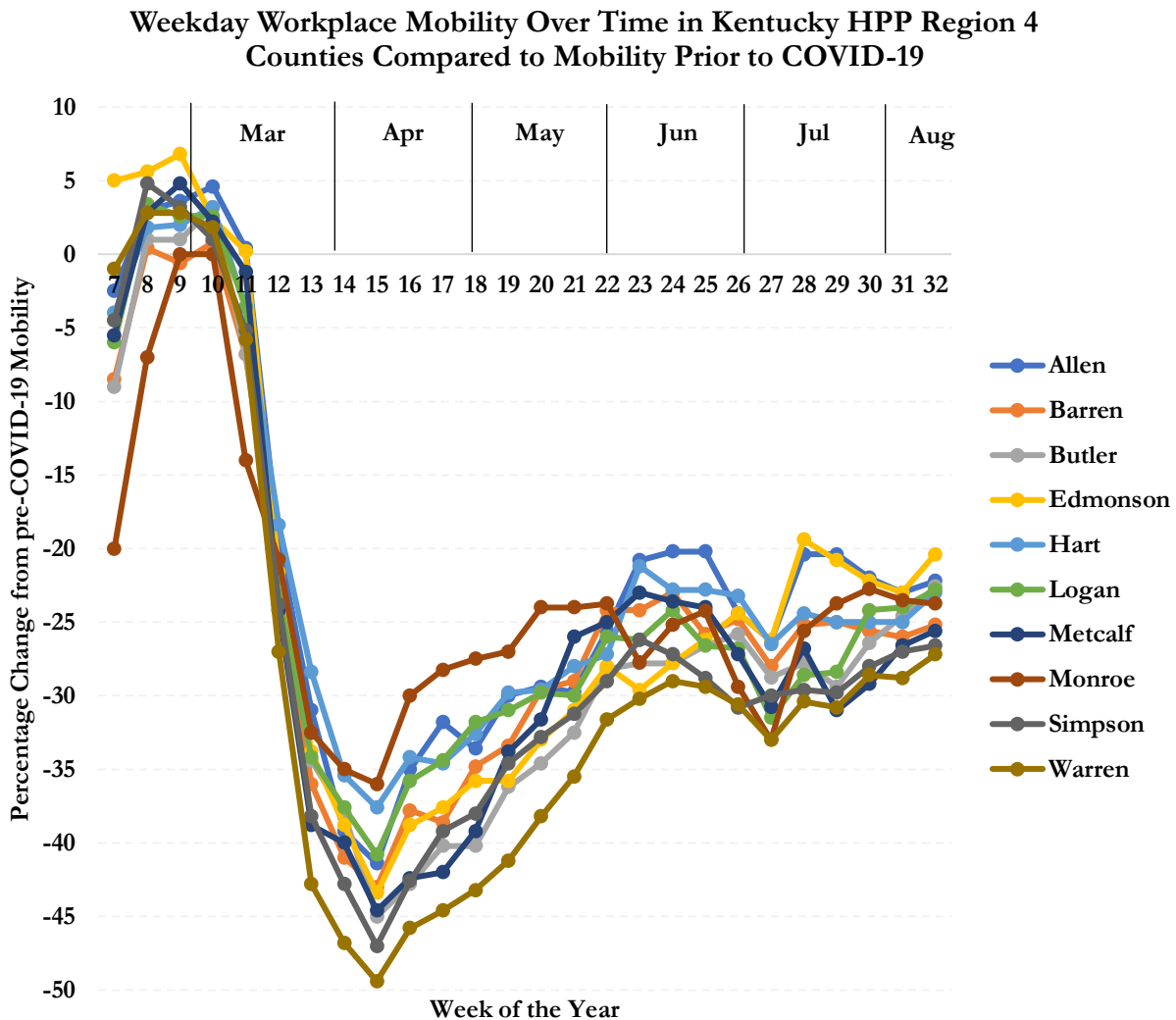
Cumulative Covid-19 deaths for the period Mar. 15 to Aug. 17, 2020 in Kentucky HPP Region 4 .
The dotted line indicates the observed data.
The highlighted path shows the median of 200 simulations.



Scenario building

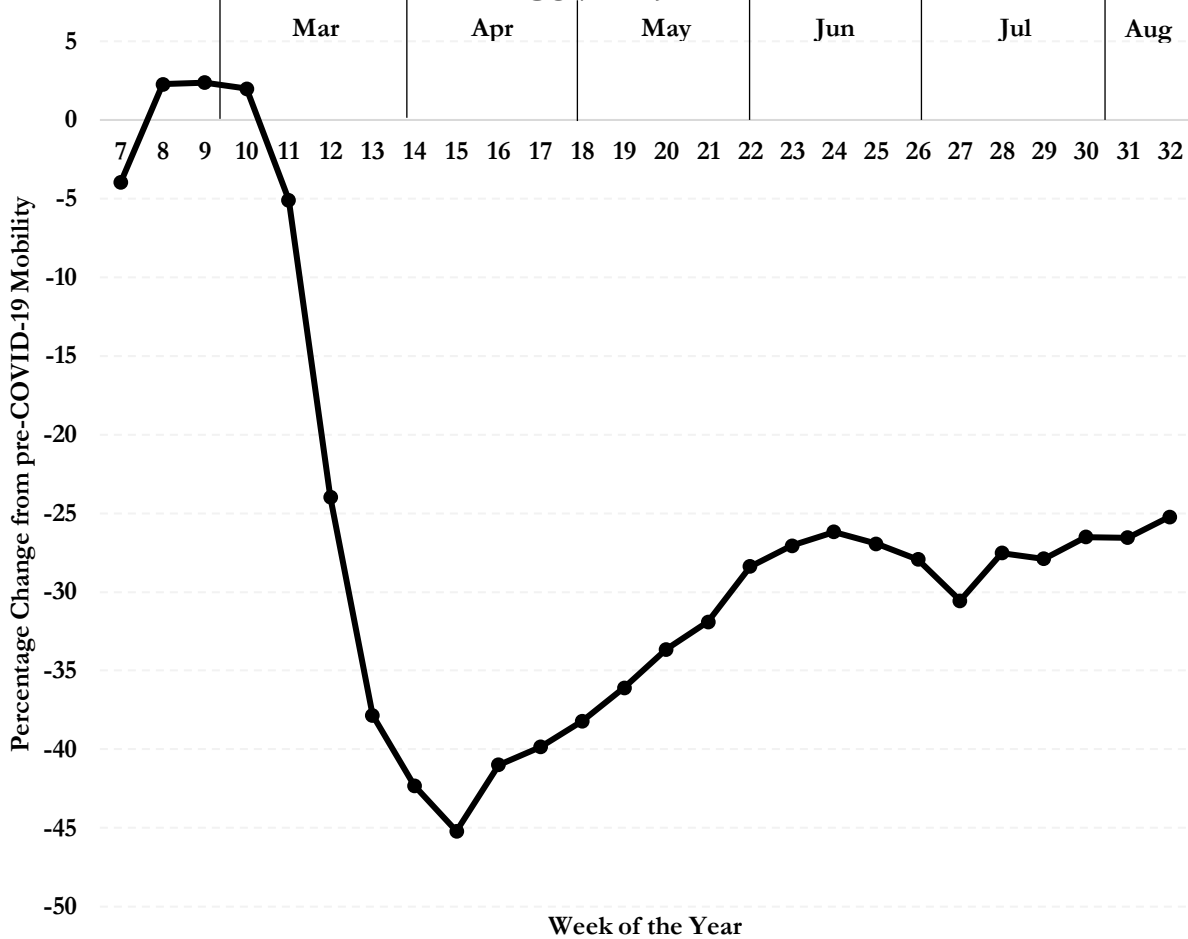
To build scenarios of contact rate changes from the projection date (Aug. 18, 2020) onward, we considered the most recent data on population mobility and mask-wearing.

- Google's data on mobility changes with respect to the pre-COVID-19 periods (specifically, the first six weeks of 2020) show that:
 - after a sharp workplace mobility decrease in the second half of March, it started to increase at a fast pace until mid-June, stabilized or decreased by mid-July, then started to increase at a slow pace until the mid-August. Workplace mobility was the most complete measure of mobility for the counties within HPP Region 4.



Source: Authors calculations using the Google community mobility report on Aug. 15, 2020 (<https://www.google.com/covid19/mobility/>)

Population-Weighted Weekday Workplace Mobility Over Time in Kentucky HPP Region 4 Counties Compared to Mobility Prior to COVID-19

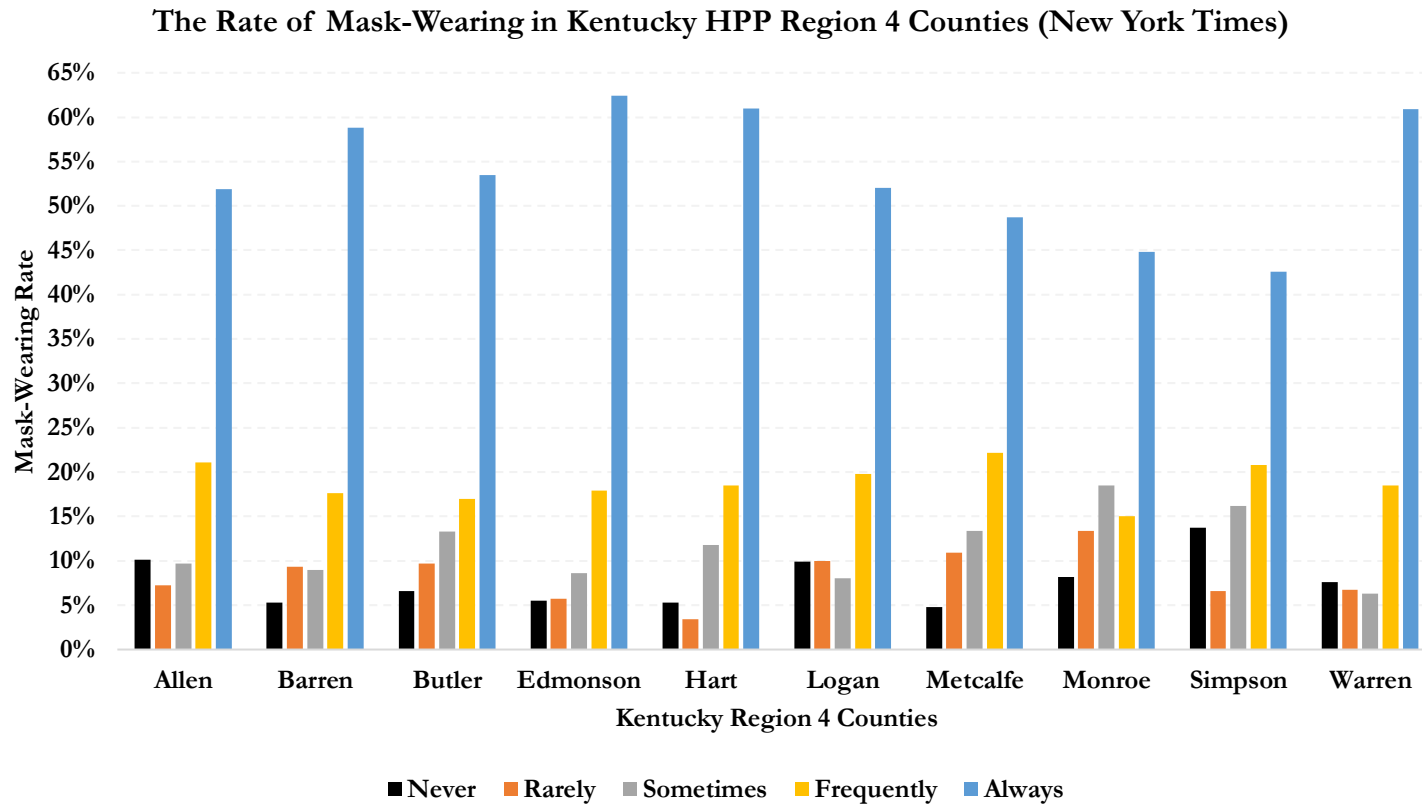


Note: To estimate workplace mobility for all counties in Kentucky HPP Region 4, the average weekday workplace mobility of each county in a week was multiplied by the share of the county’s population in the total population of Kentucky Region 4. Then, the population-weighted weekday workplace mobility was calculated as the summation of the weighted values.

Source: Authors calculations using the Google community mobility report on Aug. 15, 2020.

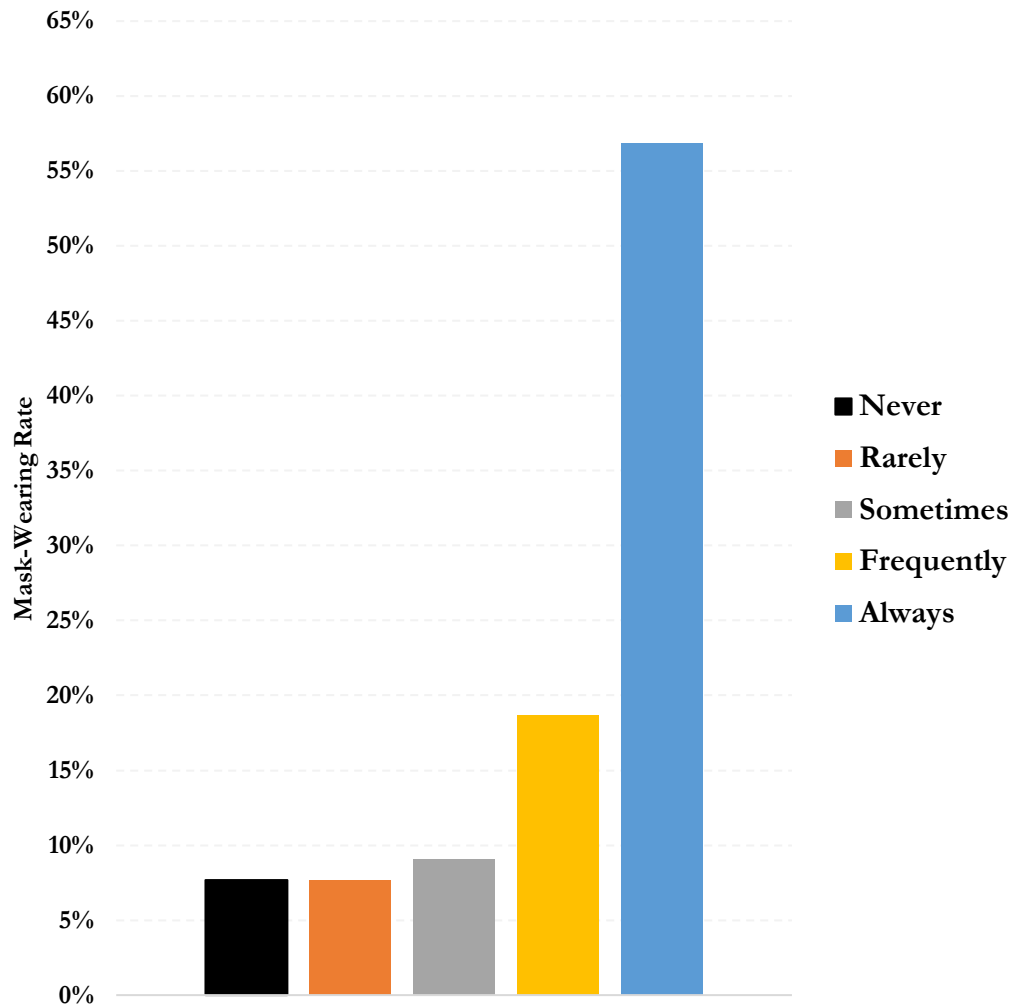
<https://www.google.com/covid19/mobility/>

- A New York Times mask-wearing survey, conducted from July 2, 2020 to July 14, 2020, showed that 43% to 62% of residents of Kentucky HPP Region 4 counties always wore a face mask in public when expected to be within 6 feet of another person; 60% to 80% always or frequently did that.



Source: Authors calculations using the the New York Times survey data on mask-wearing (<https://nyti.ms/2Bdbb5e>).

The Population-Weighted Rate of Mask-Wearing in Kentucky HPP Region 4 Counties (New York Times)



Note: The percentage of “Always” for each county was multiplied by the share of the county’s population in the total population of Kentucky HPP Region 4. Then, the population-weighted percentage of “Always” was calculated as the summation of the weighted values. The same was done for “Frequently,” “Sometimes,” “Rarely,” and “Never.”

Source: Authors calculations using the New York Times survey data on mask-wearing (<https://nyti.ms/2Bdbb5e>).

A recent Lancet systematic [review](#) and meta-analysis of the studies that examined the effect of face masks on preventing person-to-person transmission of viruses (including MERS-CoV, SARS-CoV-1, and SARS-CoV-2) summarized that simple surgical masks could reduce the risk of infection by 85% (95% Confidence Interval: 66%–93%).

Considering average effectiveness for mask-wearing of 85%, a 10% increase in mask wearing can result in an 8.5% decrease in infection transmission.

Projection Scenarios

Given the recent pattern in mobility and mask-wearing, the following projection scenarios were considered:

The ↓ sign indicates a decrease.

Scenarios	Interventions	Intervention Number	Intervention Start Date	Intervention End Date	Contact Change	
0	Continuing the Current Status Quo	None	18-Aug	17-Oct	-	
1 Mask	1 Moderate Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	10% ↓	
	2 High Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	20% ↓	
2 Mobility	1 Moderate Increase in Mobility Every Two-Weeks	1	18-Aug	31-Aug	2.5% Point ↑	
		2	1-Sep	14-Sep	2.5% Point ↑	
		3	15-Sep	28-Sep	2.5% Point ↑	
		4	29-Sep	17-Oct	2.5% Point ↑	
	2 High Increase in Mobility Every Two-Weeks	1	18-Aug	31-Aug	5.0% Point ↑	
		2	1-Sep	14-Sep	5.0% Point ↑	
		3	15-Sep	28-Sep	5.0% Point ↑	
		4	29-Sep	17-Oct	5.0% Point ↑	
3 Mask & Mobility	1 Moderate Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	10% ↓	
		1 Moderate Increase in Mobility Every Two-Weeks	2	18-Aug	31-Aug	2.5% Point ↑
			3	1-Sep	14-Sep	2.5% Point ↑
			4	15-Sep	28-Sep	2.5% Point ↑
			5	29-Sep	17-Oct	2.5% Point ↑
	2 Moderate Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	10% ↓	
		2 High Increase in Mobility Every Two-Weeks	2	18-Aug	31-Aug	5.0% Point ↑
			3	1-Sep	14-Sep	5.0% Point ↑
			4	15-Sep	28-Sep	5.0% Point ↑
			5	29-Sep	17-Oct	5.0% Point ↑
	3 High Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	20% ↓	
		3 Moderate Increase in Mobility Every Two-Weeks	2	18-Aug	31-Aug	2.5% Point ↑
			3	1-Sep	14-Sep	2.5% Point ↑
			4	15-Sep	28-Sep	2.5% Point ↑
			5	29-Sep	17-Oct	2.5% Point ↑
	4 High Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	20% ↓	
4 High Increase in Mobility Every Two-Weeks		2	18-Aug	31-Aug	5.0% Point ↑	
		3	1-Sep	14-Sep	5.0% Point ↑	
		4	15-Sep	28-Sep	5.0% Point ↑	
		5	29-Sep	17-Oct	5.0% Point ↑	

* A change in contact rate is implemented by a change in the SEIR model's transmission parameter, which is the multiplication of the probability of transmission per-contact and the per capita contact rate between the susceptible and the infectious. The latter component summarizes the effect of mask-wearing, mobility, and any personal and social protection measures.

Scenario (0)'s projections for Aug. 18 to Oct. 17, 2020

Continuing the current status quo: no change in contact rate (no change in mask-wearing rate and mobility)

Figure S0_H: Active hospitalization

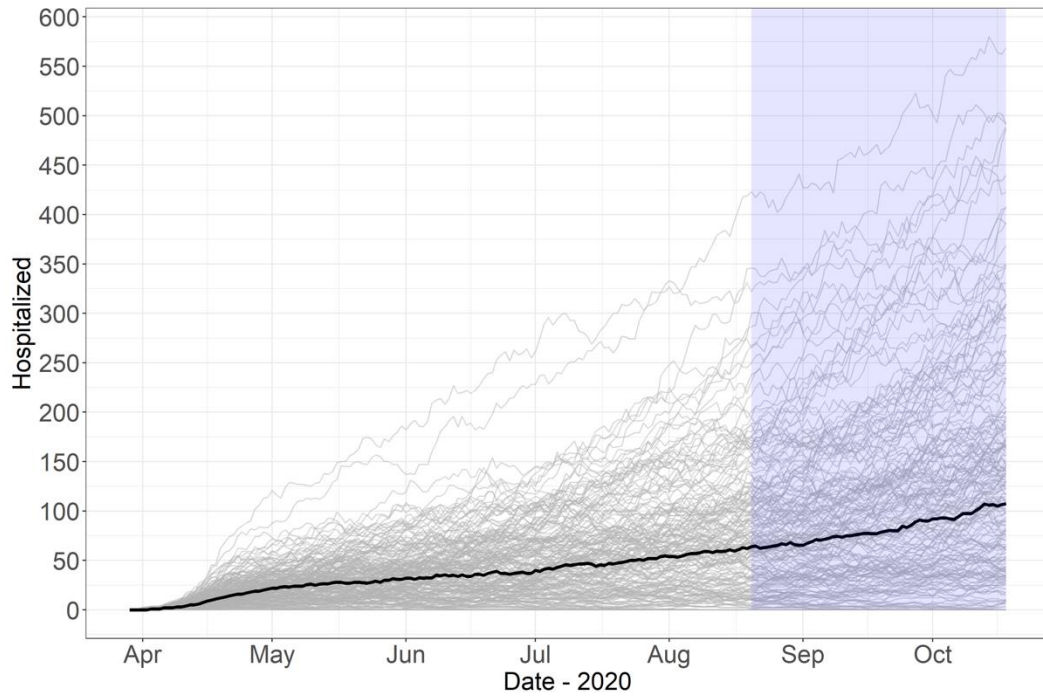
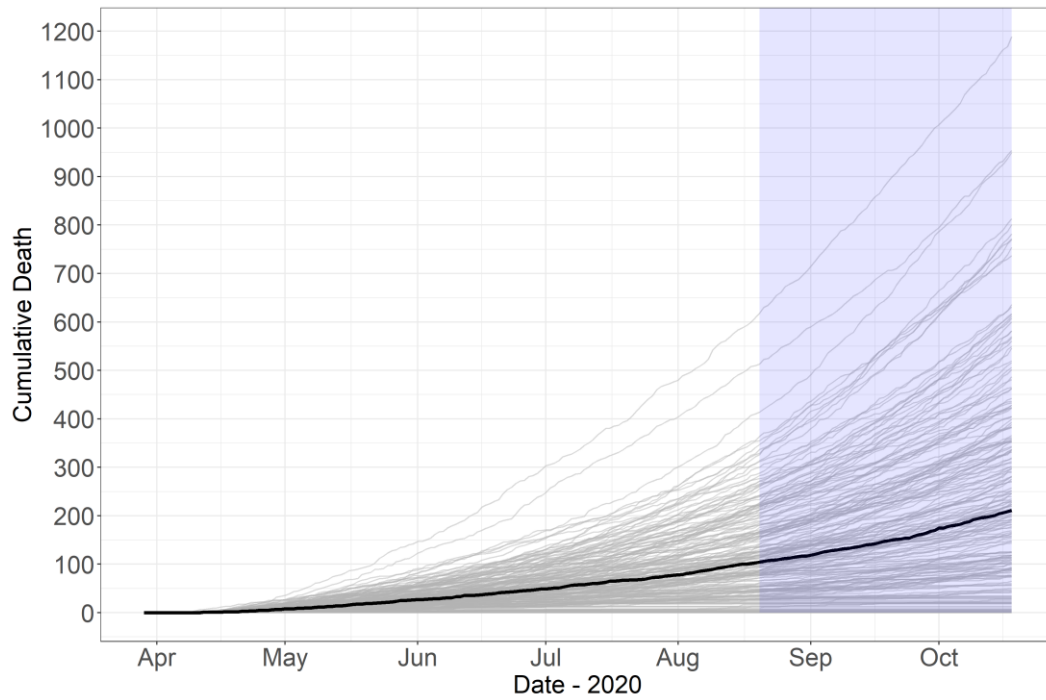


Figure S0_D: Cumulative deaths



Scenario (1.1)'s projections for Aug. 18 to Oct. 17, 2020

A moderate increase in mask-wearing that would decrease the contact rate by 10% from Aug. 18, 2020.

Figure S1.1_H: Active hospitalization

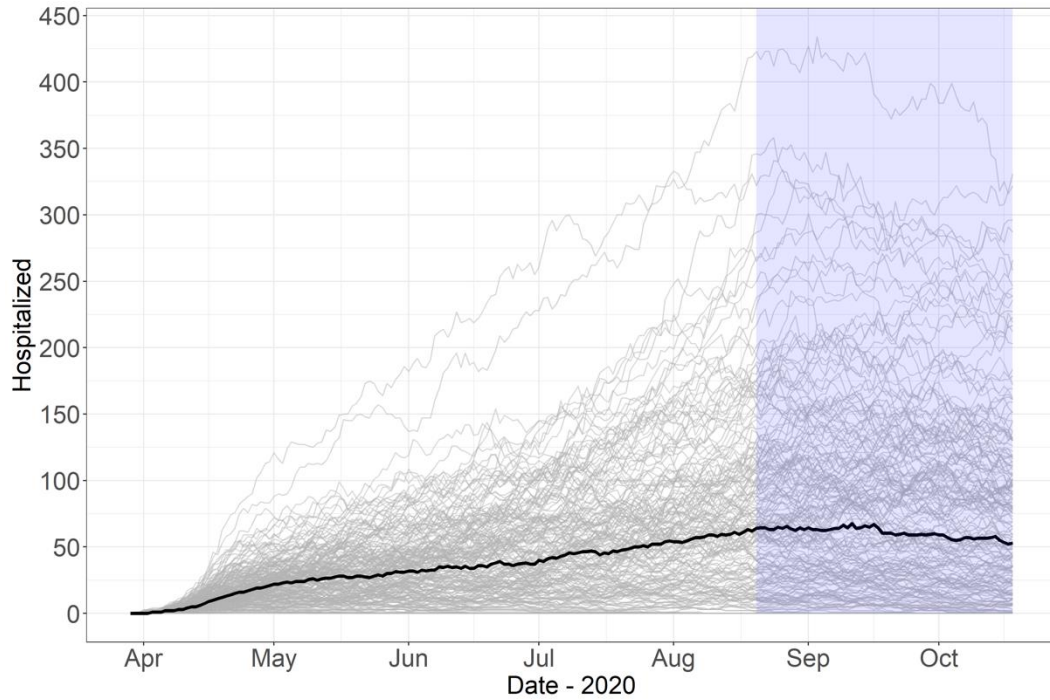
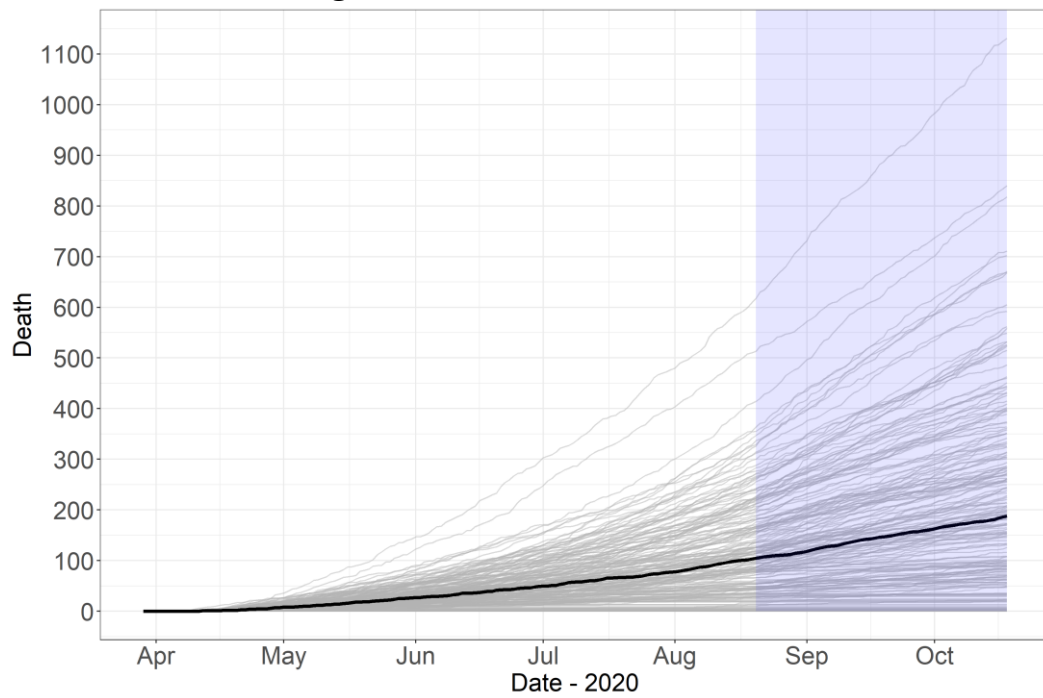


Figure S1.1_D: Cumulative deaths



Scenario (1.2)'s projections for Aug. 18 to Oct. 17, 2020

A high increase in mask-wearing that would decrease the contact rate by 20% from Aug. 18, 2020.

Figure S1.2_H: Active hospitalization

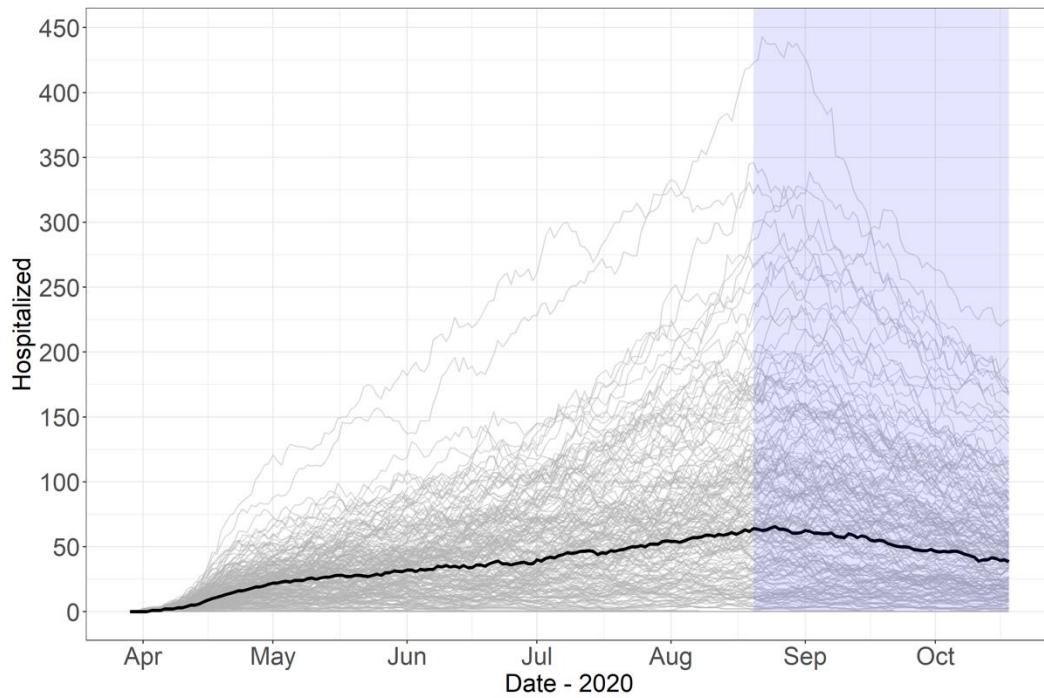
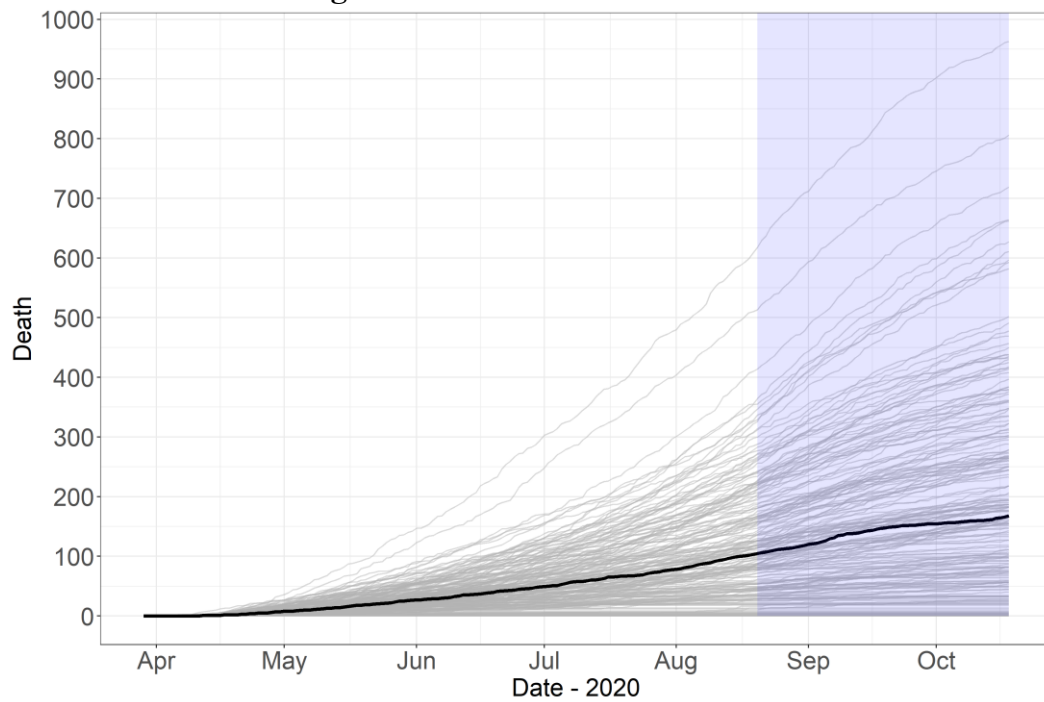


Figure S1.2_D: Cumulative deaths



Scenario (2.1)'s projections for Aug. 18 to Oct. 17, 2020

A moderate increase in mobility that would increase the contact rate by 2.5 percentage points every two weeks from Aug. 18, 2020.

Figure S2.1_H: Active hospitalization

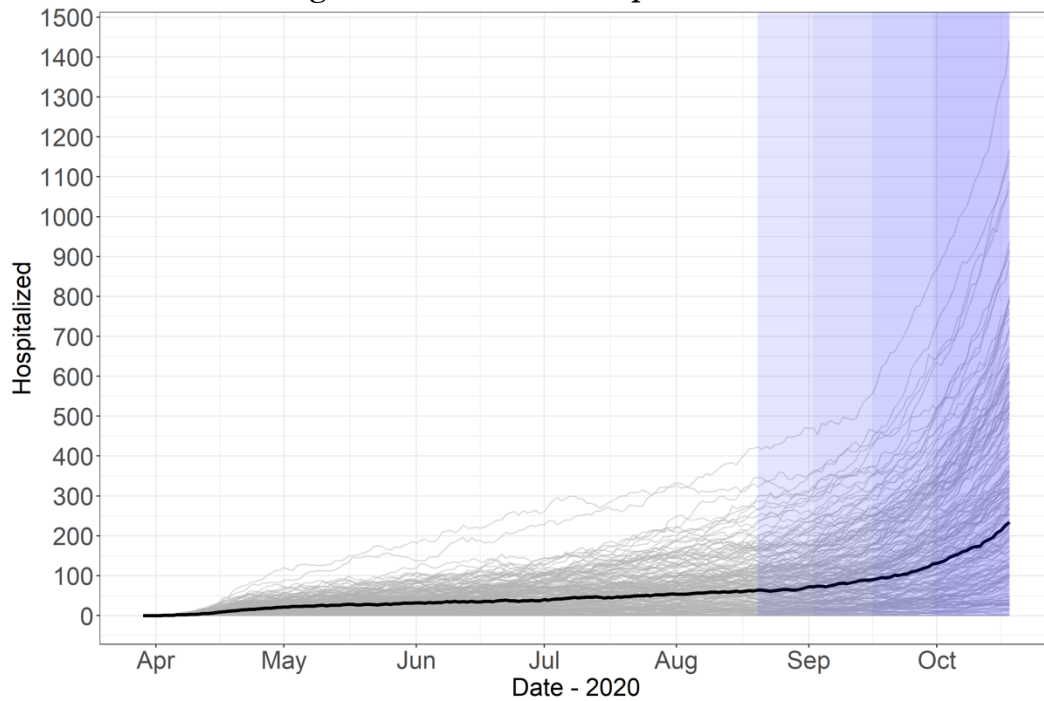
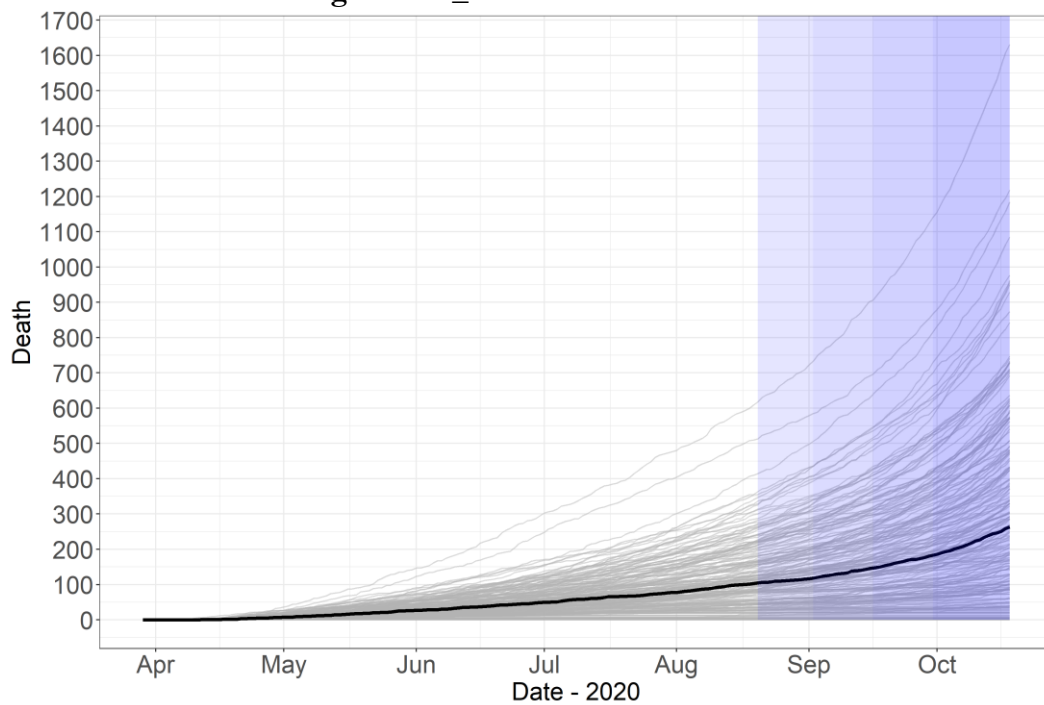


Figure S2.1_D: Cumulative deaths



Scenario (2.2)'s projections for Aug. 18 to Oct. 17, 2020

A high increase in mobility that would increase the contact rate by 5.0 percentage points every two weeks from Aug. 18, 2020.

Figure S2.2_H: Active hospitalization

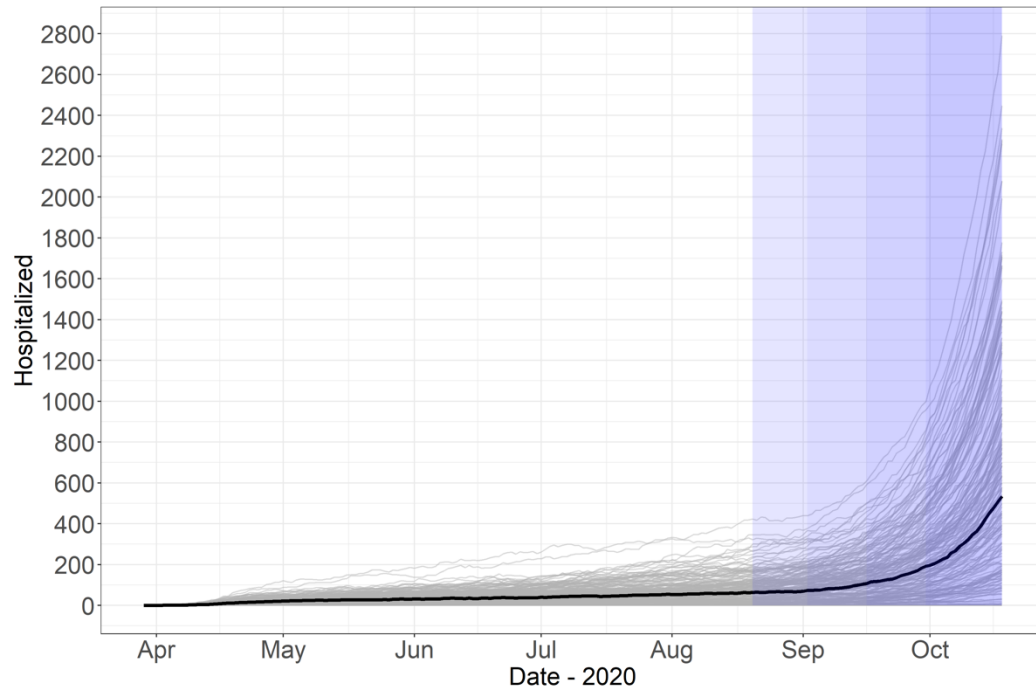
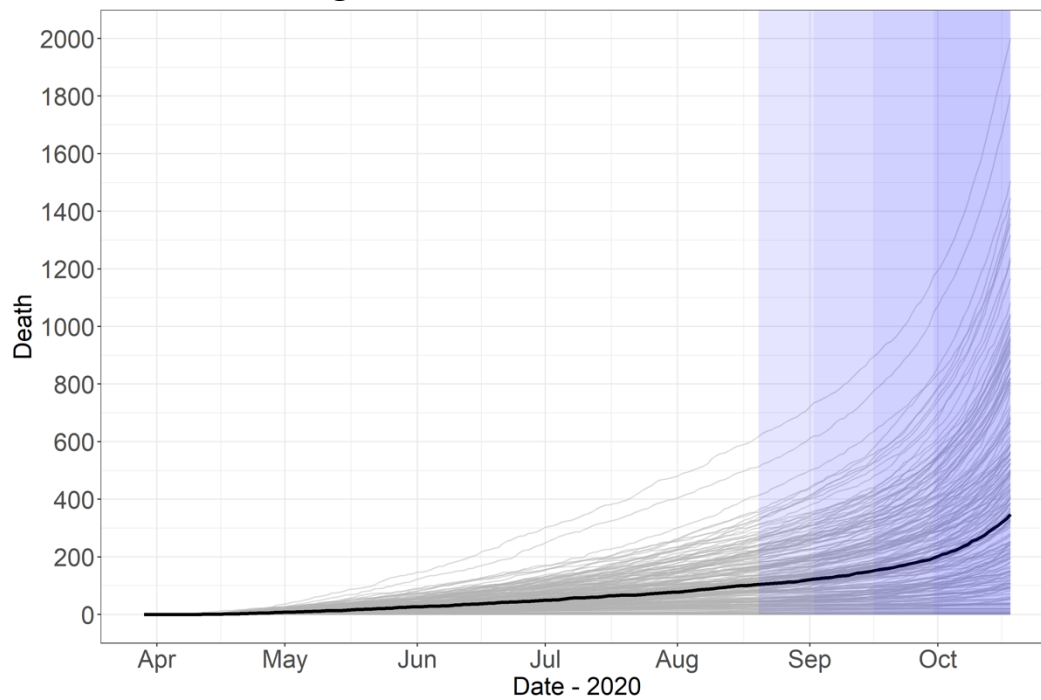


Figure S2.2_D: Cumulative deaths



Scenario (3.1)'s projections for Aug. 18 to Oct. 17, 2020

- A moderate increase in mask-wearing that would decrease the contact rate by 10% from Aug. 18, and a moderate increase in mobility that would increase the contact rate by 2.5 percentage points every two weeks from Aug. 18, 2020

Figure S3.1_H: Active hospitalization

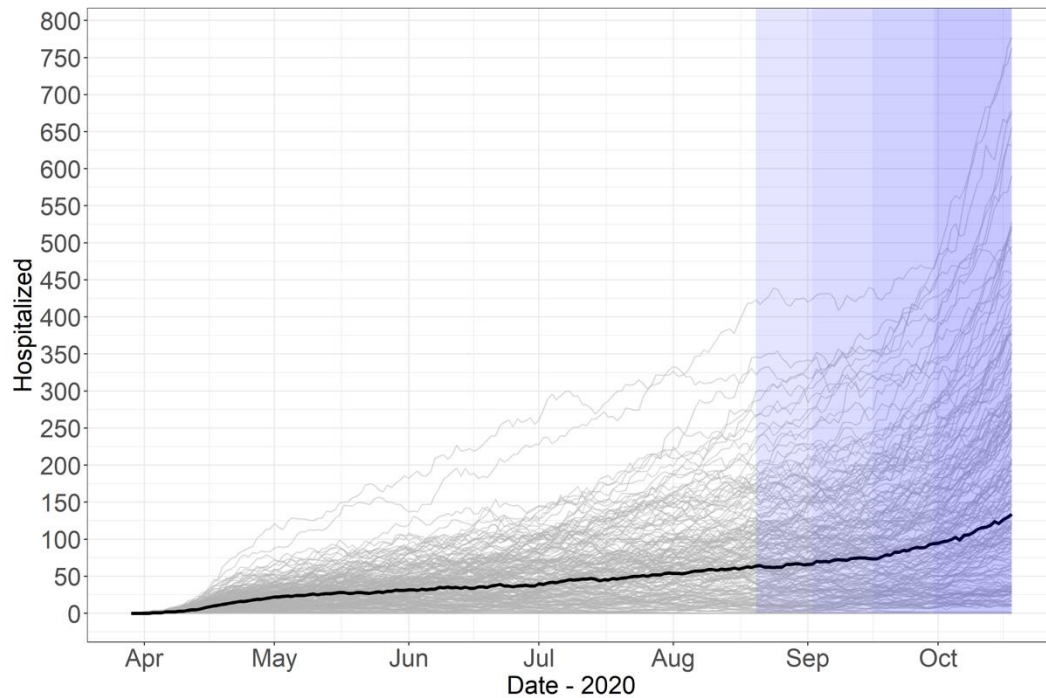
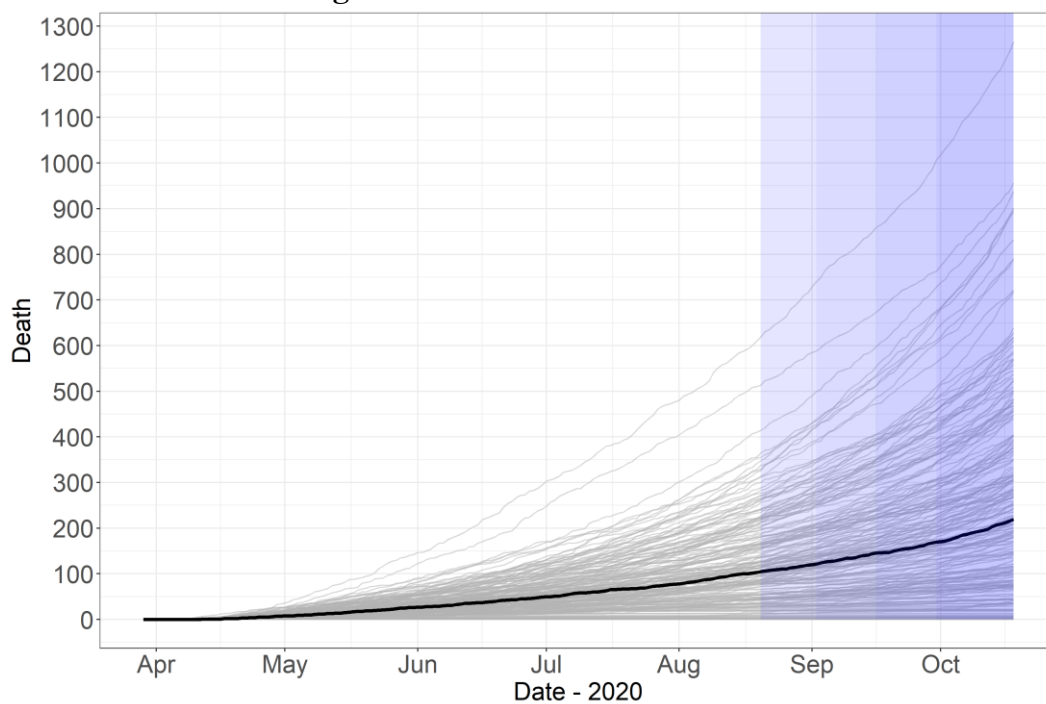


Figure S3.1_D: Cumulative deaths



Scenario (3.2)'s projections for Aug. 18 to Oct. 17, 2020

- A moderate increase in mask-wearing that would decrease the contact rate by 10% from Aug. 18, and a moderate increase in mobility that would increase the contact rate by 5.0 percentage points every two weeks from Aug. 18, 2020.

Figure S3.2_H: Active hospitalization

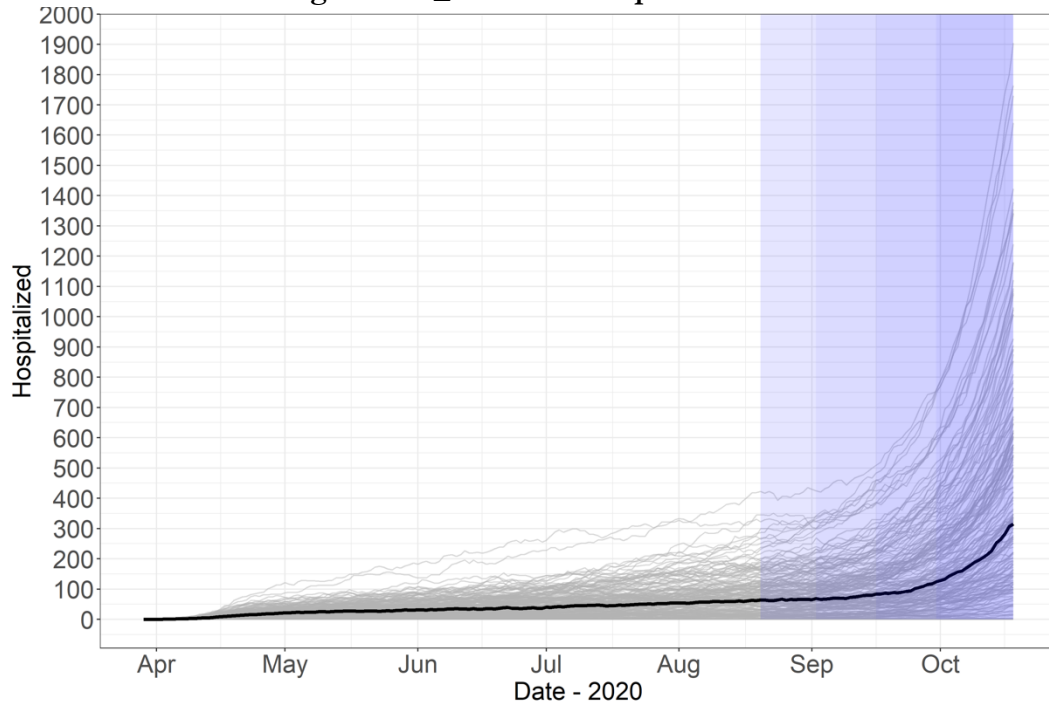
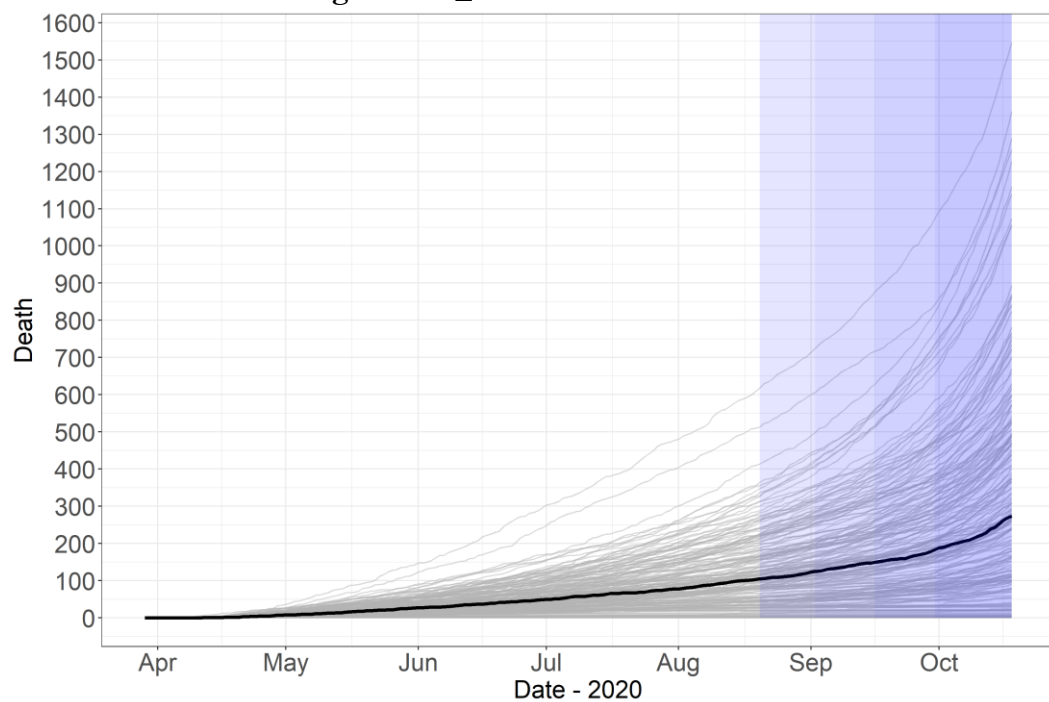


Figure S3.2_D: Cumulative deaths



Scenario (3.3)'s projections for Aug. 18 to Oct. 17, 2020

- A moderate increase in mask-wearing that would decrease the contact rate by 20% from Aug. 18, and a moderate increase in mobility will increase the contact rate by 2.5 percentage points every two weeks from Aug. 18, 2020

Figure S3.3_H: Active hospitalization

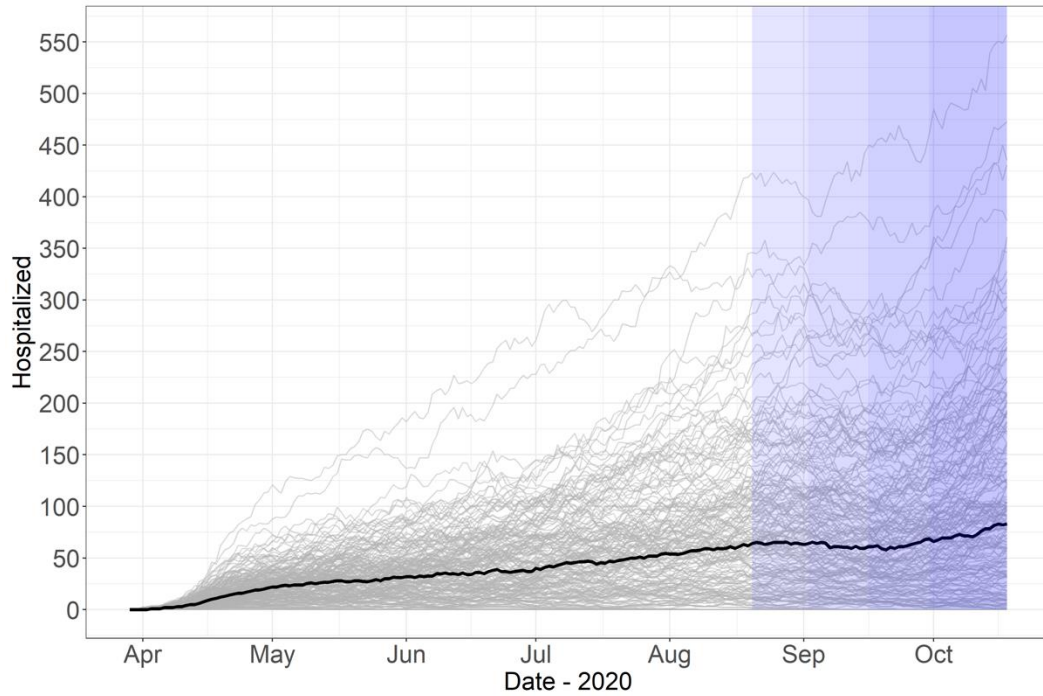
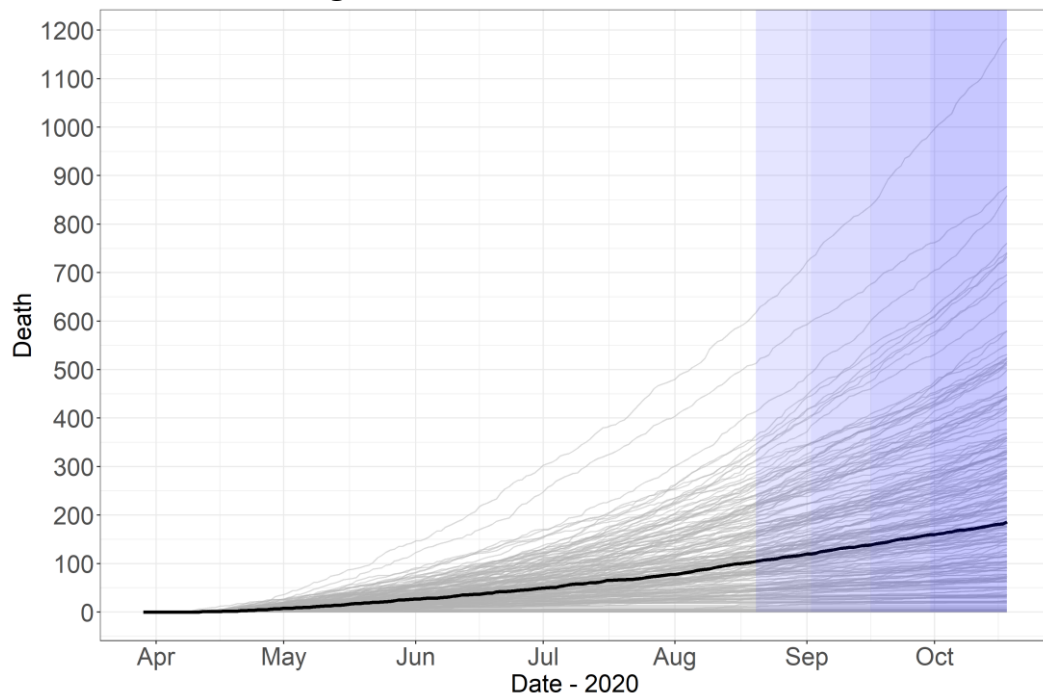


Figure S3.3_D: Cumulative deaths



Scenario (3.4)'s projections for Aug. 18 to Oct. 17, 2020

- A moderate increase in mask-wearing that would decrease the contact rate by 20% from Aug. 18, and a moderate increase in mobility will increase the contact rate by 5.0 percentage points every two weeks from Aug. 18, 2020.

Figure S3.4_H: Active hospitalization

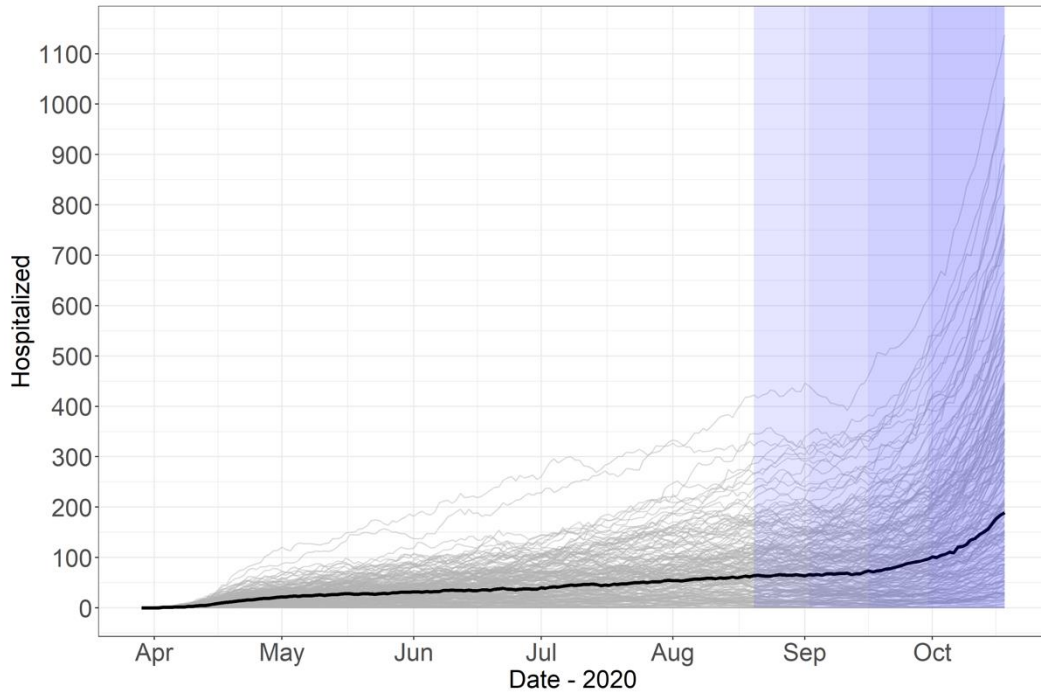
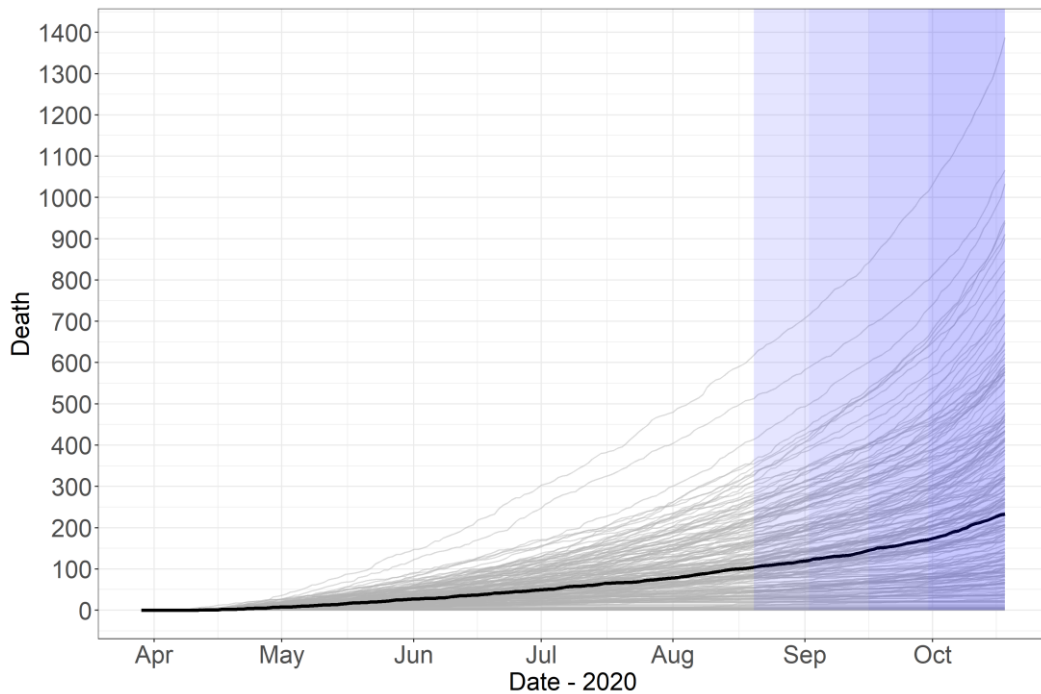


Figure S3.4_D: Cumulative deaths



Summary of Projection Results:

- **This report investigated the simulated effect of mask-wearing and mobility changes in the contact rate.** We considered scenarios of moderate and high increase in mask-wearing rates and changes in mobility from the first date of projection, August 18, 2020. *For these scenarios, the projections for hospitalizations and deaths are made until mid-October. These projections are based on medians of 200 simulations.*
- **In Kentucky HPP Region 4, the percentage of people who always wore a face mask in public when within 6 feet of others was 57% in early July.** While this rate might have increased after the State's mask order went into effect on July 10, we scenarios of further moderate and high increases in mask-wearing from August 18, 2020.
- **In Kentucky HPP Region 4 counties, weekday workplace mobility has been slowly increasing since mid-July.** We assumed that it continues to increase at two different paces: moderate and high, respectively, 2.5 and 5.0 percentage points every two weeks. We further assumed that these changes translate to the same changes in the contact rate.
- **The status quo scenario (no change in mask-wearing and mobility rates) estimates that by mid-October:**
 - active hospitalizations will increase to approximately 107
 - total deaths will increase to approximately 209
- **Scenario 1 (increase in mask-wearing rate & no change in mobility) estimates that by mid-October** with a moderate/high increase in the mask-wearing rate and no change in mobility rate, the number of:
 - active hospitalizations will increase to approximately 52/40
 - total deaths will increase to approximately 186/166
- **Scenario 2 (no change in mask-wearing rate & increase in mobility) estimates that by mid-October** with no change in the mask-wearing rate but a moderate/high increase in mobility, the number of

- hospitalizations will increase to approximately 226/508
- total deaths will increase to approximately 259/332
- **Scenario 3 (increase in both mask-wearing rate & mobility) estimates that by mid-October** with a moderate increase in the mask-wearing rate and a moderate/high increase in mobility, the number of:
 - hospitalizations will increase to approximately 130/307
 - total deaths will increase to approximately 216/269

With a high increase in the mask-wearing rate and a moderate/high increase in mobility, the number of:

- hospitalizations will increase to approximately 82/184
- total deaths will increase to approximately 182/231.

Therefore, *mask-wearing cannot/will not be able to mitigate high mobility rates.*

Model Projection Results Summary Table

Scenarios	Interventions	Intervention Number	Intervention Start Date	Intervention End Date	Contact Rate* Change	Projected Active Hospitalizations/Deaths in mid-October: Hospitalizations/Deaths
0	Continuing the Current Status Quo	None	18-Aug	17-Oct	-	107 / 209
1 Mask	1 Moderate Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	10% ↓	52 / 186
	2 High Increase in Mask-Wearing Rate	1	18-Aug	17-Oct	20% ↓	40 / 166
2 Mobility	1 Moderate Increase in Mobility Every Two-Weeks	1	18-Aug	31-Aug	2.5% Point ↑	226 / 259
		2	1-Sep	14-Sep	2.5% Point ↑	
		3	15-Sep	28-Sep	2.5% Point ↑	
		4	29-Sep	17-Oct	2.5% Point ↑	
	2 High Increase in Mobility Every Two-Weeks	1	18-Aug	31-Aug	5.0% Point ↑	508 / 332
		2	1-Sep	14-Sep	5.0% Point ↑	
		3	15-Sep	28-Sep	5.0% Point ↑	
		4	29-Sep	17-Oct	5.0% Point ↑	
3 Mask & Mobility	1 Moderate Increase in Mask-Wearing Rate Moderate Increase in Mobility Every Two-Weeks	1	18-Aug	17-Oct	10% ↓	130 / 216
		2	18-Aug	31-Aug	2.5% Point ↑	
		3	1-Sep	14-Sep	2.5% Point ↑	
		4	15-Sep	28-Sep	2.5% Point ↑	
		5	29-Sep	17-Oct	2.5% Point ↑	
	2 High Increase in Mask-Wearing Rate High Increase in Mobility Every Two-Weeks	1	18-Aug	17-Oct	10% ↓	307 / 269
		2	18-Aug	31-Aug	5.0% Point ↑	
		3	1-Sep	14-Sep	5.0% Point ↑	
		4	15-Sep	28-Sep	5.0% Point ↑	
		5	29-Sep	17-Oct	5.0% Point ↑	
	3 High Increase in Mask-Wearing Rate Moderate Increase in Mobility Every Two-Weeks	1	18-Aug	17-Oct	20% ↓	82 / 182
		2	18-Aug	31-Aug	2.5% Point ↑	
		3	1-Sep	14-Sep	2.5% Point ↑	
		4	15-Sep	28-Sep	2.5% Point ↑	
		5	29-Sep	17-Oct	2.5% Point ↑	
	4 High Increase in Mask-Wearing Rate High Increase in Mobility Every Two-Weeks	1	18-Aug	17-Oct	20% ↓	184 / 231
2		18-Aug	31-Aug	5.0% Point ↑		
3		1-Sep	14-Sep	5.0% Point ↑		
4		15-Sep	28-Sep	5.0% Point ↑		
5		29-Sep	17-Oct	5.0% Point ↑		